

SIMPLE MEASURES TO ENCOURAGE MORE NOTE-TAKING IN THE ERA OF ELECTRONIC NOTEBOOKS AND THEIR EVALUATIONS

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Abstract

It is important to have students take notes so as to increase their concentration. We examined how students take notes by providing paper notebooks and PC notebooks, each of which are provided with a fill-in-blanks section and a free writing section. The results show that, 93.9% of the fill-in-blanks areas of paper and PC notebooks were written, while only 14.0% of the free writing areas were. In test results, questions related to the “fill-in-blanks” area resulted in significantly higher scores than those related to the free-writing area. Further, comparisons between the paper and PC notebook users showed that the PC notebook users earned higher scores on the questions related to free-writing section.

Keywords: Electronic Notebooks, Electronic Textbooks, Measure of Note-Taking, Fill-in-Blank section, Free Writing section, Evaluation of Learning.

1 Introduction

DiTT (Association of Digital Textbook & Teaching 2012) has proposed to the Japanese government the distribution of electronic notebooks and electronic textbooks to 10 million elementary and junior high school students around the country in three years. The plan calls for distribution to 30 thousand schools with 670 thousand teachers using the devices. The electronic notebooks and electronic textbooks have numerous merits and compared with traditional paper notebooks and textbooks they also have a wider variety of applications, however, if used improperly they can also become a bad influence on the students. Simple and easy ways to use the devices for effective learning must be compellingly presented, even to those teachers with limited or no computer skills or experience.

There have been some studies analyzing the relationship between the amounts of notes students take in class and their post test scores. They concluded that there is a strong correlation between them (Kishi,

Thukada and Nojima 2004). Also, several studies examined the effect of free note-taking on reading comprehension skills. They also indicated that free note-taking has a positive impact on grades (Nozaki et al. 2005). However, there is no research that suggests how students could be motivated to take more notes. On the other hand, about the effect of the acquirement of knowledge by the note-taking, the coherent knowledge was not provided (Hartley and Davies 1978), (Hartley 1983).

The use of a projector with computer, instead of writing on the blackboard, is effective in speeding up lectures, but students become passive in class and take fewer notes compared with the use of blackboard. To compensate for this effect, we made an arrangement to give repeated tests outside class. As a result, the increased number of tests improved students' grades (Yamamoto, Nakayama and Shimizu 2012). This, however, does not mean that students are more focused during the class.

In the mean time, some studies have evaluated the effects of different input mediums in e-learning, such as pen- tablet and paper, key boards and tablet PCs, on memory retention and understanding. The analyses performed from different viewpoints indicated that tablet PCs are the most effective (Ando and Ueno 2011). Moreover there are many studies about note-taking (Nakayama, Mutsuura, and Yamamoto, 2010), (Weener, 1974), (Kiewra, 1989), (Trafton and Trickett 2001), (Nakayama, Mutsuura, and Yamamoto, 2011).

This study compares fill-in-blanks style writing (herein after called “fill-in”) and free-style writing (herein after called “free”), as a simple and practical note-taking method, based on an experiment described later. Analyses were done on the amount of writing and test scores. Moreover we examined whether or not there were any difference between the note-taking mediums(paper notebook and PC notebook, i.e. writing software installed in personal computers) in terms of their effect on the test scores.

We divided students into two classes, class A and class B. And we gave two sequential lectures on career planning to each class. Both first and second lectures of 110 minute each were given at one o'clock in the afternoon. Although 10- minute break was given, this is the time period when students are expected to lose concentration. The summary of the results are presented below.

1. The amount of writing in the “fill-in” section was 6.7 times that in the “free” section.
2. The test score of “fill-in” section were 1.6 times higher than that of the “free” section.
3. The use of PC notebooks led to higher test scores than that of paper notebooks.

“Fill-in” is obviously a simple note-taking method, but the significance of this study is that it quantitatively verified it by conducting an actual classroom experiment. We also believe that the “fill-in” method is useful for formative evaluation since it provides instructors with immediate feedback.

2 Method

In the experiment, 121 freshmen of a vocational school were given a lecture on career planning once a week. All students but 16 in one department owned a personal computer, and therefore most students had no problem using a PC as a note-taking tool. The Table 1 shows details of the classroom experiment.

Round of Lecture	Class (day of the week)	Media of note		Contents	notes) Number of Questions (full marks)
		Paper(learners)	PC(learners)		
First	A (Mon.)	Paper(66) (fill in) + free		For 1round	[5] + 5 (20marks)
	B (Thur.)		PC(48) free + (fill in)		5 + [5] (20marks)
Second (next week)	A (Mon.)	Paper(16) (fill in) + free	PC(47) (fill in) + free	For 2round	[10] + 10 (20marks)
	B (Thur.)	Paper(54) free + (fill in)			10 + [10] (20marks)

Note) on the test sheets, [Numbers] indicates the number of questions related to “fill-in” note-taking, and **Numbers** indicates the number of questions related to “free” note-taking.

Table 1. Details of the classroom experiment

Two lectures on “Useful hints when charring out service-related operations” as part of a career planning were given over two weeks. In this experiment, students were grouped into Class A and Class B. Class A comprises 67 students from the Hotel Course, Office Business Course, Patisserie Course and Animal Health Technician Course, while Class B comprises 54 students from Creative Design Course, Total Beauty Course and Pet life Care Course. The lectures were administered on Mondays for Class A and on Thursdays for Class B.

The first lectures were exactly the same for both Class A and Class B, and so were the second lectures. In the lectures, an instructor added comments during the presentation using an overhead projector. He chose two important words on each screen and circled them in red and further emphasized them by sliding a rectangle to encircle each word, via an animation function.

Students are instructed to either take notes on paper notebooks given to them, or input notes in their own PC notebooks. For “fill-in” note-taking, both type of notebooks were provided with rectangle input areas covering some words and phrases in lecture materials, while a large square-shaped input area were given at the bottom of each page for “free” note-taking.

The students were not informed about the experiment or tests so as to prevent their expectations from entering the data. However, they were instructed to “write (or input) as much as possible on the distributed sheets of paper or their personal computers”. The test given after the second lecture was designed to have double the input area and double the number of questions of the first test. This was to reduce bias between the first and second tests, assuming that the students would have expected the test after the second lecture.

To prevent bias between the two groups, Class A was assigned to use paper notebooks and Class B to use PC notebooks for the first lecture, and vice versa for the second. In addition, “fill-in” and “free” materials were presented alternately on the projector screen as well. Further, the order of “fill-in” and “free” presentations in Class A in the first lecture was reversed for Class B (See Table 1 and Figure 1).

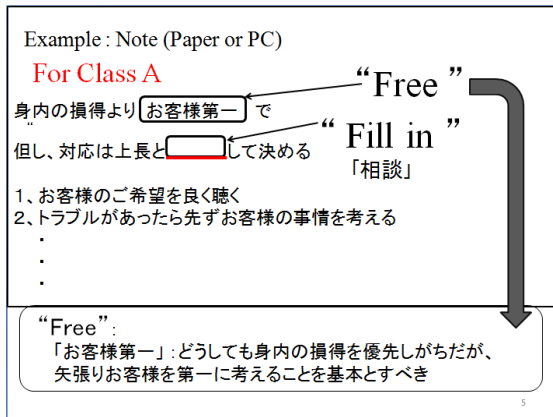


Figure 1. Example of Note for Class A

It should be noted that because 16 students in the Patisserie Course did not own PCs, they used paper notebooks in both of the first and second lectures.

As for the tests, the first one, which has the total of 10 questions (five “fill-in” and five “free” questions), was administered during the last 10 minutes of the first class. In the second test, to reduce the effect of the expectations the students might have formed after the “first test”, we included 20 questions, double the first one, and allocated 15 minutes. The full score for both the first and second tests were set at 20. When measuring the amount of writing, if there was any kind of writing, it was counted as one unit of writing regardless of its content, correctness or length, for both “fill-in” and “free” sections. In the tests, if students wrote exactly the same words or phrases as had been presented in a lecture, ○ is given, × otherwise.

3 Results

3.1 Evaluation of bias in test scores between Classes A and B, and between the first and second lectures

To evaluate the results, first, we examined whether or not there was any bias in scores between Classes A and B. The result is shown in Table 2. As it shows, the average of the total of two scores for Class A was 11.16 points, and for Class B 10.94 points. The difference between the two was 0.22, showing no statistical significance ($t=0.35$, N.S.). The data of students who were absent from either one of the tests was excluded from the analyses because comparisons cannot be made.

ClassA <i>n</i> =127	ClassB <i>n</i> =107	Difference	<i>t value</i> Significance
11.16	10.94	0.22	0.35
(4.34)	(4.80)		N.S.

Numbers indicates test scores, Full marks=20, (Standard deviation)

Table 2. Evaluation of bias in test scores between Class A and B

Next, we examined whether or not there was any bias between the first and second lectures. The result is shown in Table 3. As it shows, the average score of the first lecture was 11.12 points, and the second 11.01 points. The difference was 0.11 points, showing no statistical significance ($t=0.19$, N.S.).

First <i>n</i> =128	Second <i>n</i> =115	Difference	<i>t value</i> Significance
11.12	11.01	0.11	0.19
(4.61)	(4.40)		N.S.

Numbers indicates test scores, Full marks=20, (Standard deviation)

Table 3. Evaluation of bias in scores between the first and second lectures

3.2 Comparison of the amounts of writing between two types of notebooks

We compared the amount of writing between the “fill-in” and “free” sections for paper notebooks and PC notebooks. The results are shown in Table 4.

When measuring amount of writing, if there was any kind of writing, it was counted as one unit regardless of its content, correctness or length. We expected students to write down key words or matters that they thought important. As Table 4 shows, the average unit of writing on a paper notebook was 9.17 units for the “fill-in” section, and 1.27 units for the “free” section, showing a statistically significant difference of 7.90 units ($t=29.82$, $p<0.001$). On a PC, the average unit of input was 9.71 for the “fill-in” section and 1.6 units for the “free”, with a difference of 8.11 units ($t=20.84$, $p<0.001$).

In addition, it is interesting that the students wrote more amounts of writing in PC notebooks than paper notebooks. The results are shown in figure 5.

Media of Note	“Fill in”	“Free”	Difference	<i>t value</i> Significance
Paper <i>n</i> =136	9.17 (1.85)	1.27 (2.80)	7.90	29.82 <i>p</i> <0.001
PC <i>n</i> =95	9.71 (1.14)	1.60 (3.73)	8.11	20.84 <i>p</i> <0.001
Total <i>n</i> =231	9.39 (1.61)	1.40 (3.21)	7.99	35.81 <i>p</i> <0.001

Numbers indicates amounts of writing, Max=10.00, (Standard deviation)

Table 4. Comparison of the amounts of writing two types of notebooks

The average amount of writing on paper and PC was 9.39 (93.9%)units for the “fill-in” section and 1.40 (14.0%) for the “free” section, with 7.99 unit difference($t=35.81$ $p<0.001$). Therefore, the average writing (and input) amount of the “fill-in” section is 6.7 times that of the “free” section. Figure 2 presents graphs showing the amounts of note-taking on paper and PCs.

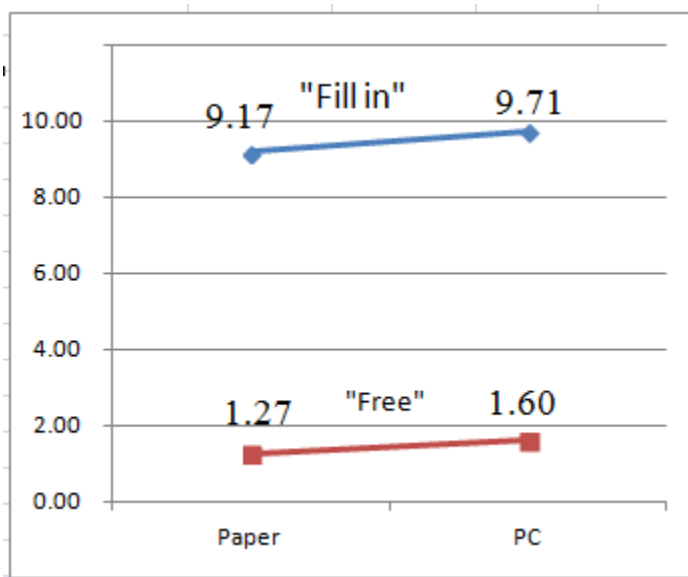


Figure 2. Results: Amount of Writing(Max=10.00)

3.3 Test results

Next, we present the test results in Table 5. As it shows, the students who used paper notebooks earned 6.70 points in the “fill-in” section and 3.88 points in the “free” section, showing a significant difference of 2.82 points($t=13.93$, $p<0.001$).

Media of notebook	“Fill-in”	“Free”	Difference	<i>t value</i> Significance
Paper <i>n</i> =137	6.70 (2.61)	3.88 (2.35)	2.82	13.93 <i>p</i> <0.001
PC <i>n</i> =105	6.66 (2.69)	5.02 (2.74)	1.64	6.03 <i>p</i> <0.001
Total <i>n</i> =242	6.68 (2.64)	4.37 (2.58)	2.31	13.71 <i>p</i> <0.001

Numbers indicates test scorers , Full marks=10, (Standard deviation)

Table 5. Test result

The students who used a PC earned 6.66 points in the “fill-in” section and 5.02 points in the “free” section, showing a significant difference of 1.64 points ($t=6.03$, $p<0.001$). The combined average of the paper and PC users was 6.68 points for the “fill-in” section and 4.37 points for the “free” section, with 2.31 point difference ($t=13.71$, $p<0.001$).

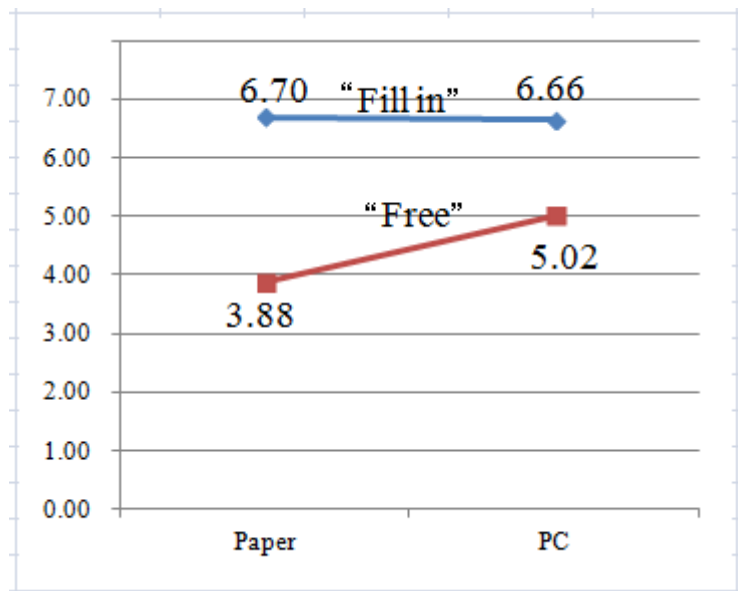


Figure 3. Results of Test Scores(Full Marks=10.00)

As shown above, whether students used paper or PCs, the test scores of the “fill-in” section were significantly higher than that of the “free” section. Therefore, I understood that the “fill-in” section method were very effective when we let the students take the notebooks.

Next, we will analyze interactions. Figure 3 presents the scores grouped into paper and PC using groups, each of which was further divided into “fill-in” and “free”. It shows that for the “free” section, the PC users earned higher scores than the paper users.

Table 6 presents the results of the analysis of variance. It shows that the main effects of both “fill-in” and “free” were significant with less than 1% significance level. For both of the note-taking mediums, paper and PCs, the main effects were found significant with less than 5 % significance levels. As for the “free” section, the PC users showed higher test scores than the paper users. For the interaction term, the significant difference level was less than 5%. I think that the reasons of high scores in “free” section are because the PCs notebooks are color and easy to stay in the impression of the students. About this matter, we think that it is necessary to inspect by the next experiment exactly.

Factor	SS	df	MS	F	P	Judgment
Measure of Note-Taking(A)	591.97	1	591.97	88.54	<.0001	* *
Media of Note(B)	35.93	1	35.93	5.37	0.02	*
A×B	41.86	1	41.86	6.26	0.012	*
W	3209.24	480	6.69			

Table 6. Analysis of variance

* * : 1% Level, * : 5% Level

3.4 Relations between amount of writing and test scores

We analyzed relationship between the amount of writing and test results based on the data summarized in Tables 4 and 5. Figure 4 shows the analysis results. We found “medium-level positive correlation” between the amount of writing and the test score, with the correlation coefficient (r) equaling 0.65(t=9.61, p=1.02E-16). It should be noted that the amounts of writing are concentrated around 20 units because many students wrote in the “fill-in” section, but not in the “free” section.

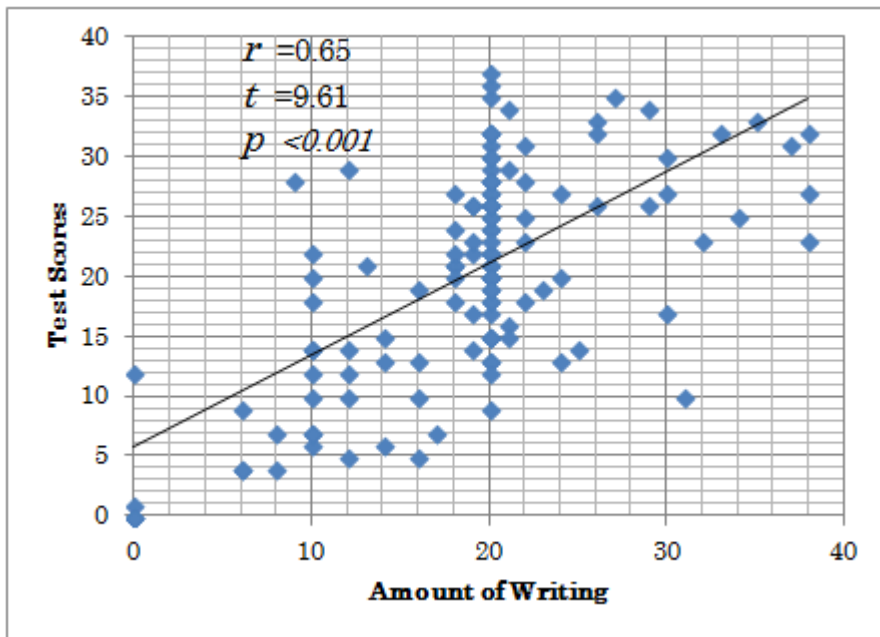


Figure 4. Correlation Between Amount of Writing and Test Scores

4 Conclusion

We analyzed the relationship between the amount of writing and the test score for the “fill-in” and “free” sections. The average amount of writing in the “fill-in” section was 93.9% and that in the “free” section was 14.0%. The amount of writing in the “fill-in” section was 6.7 time that in the “free” section. We found that regardless of the use of paper or PCs, the writing amount in the “fill-in” section is dramatically higher, and that students fill in most of the “fill-in” section. As for the test scores, the average score of the “fill-in” section was 6.68 points (out of 10), while that of the “free” section was 4.37 points. The average of “fill-in” scores was 1.6 times larger than that of “free” scores.

Examination of relationship between the writing amount on paper and input amount in PCs revealed that in terms of writing in the “free” section, the use of PC notebooks led to a higher score than writing on paper.

The correlation (r) between the amount of notes taken and the test score was 0.65($t=9.61$, $p=1.02E-16$).

Our future challenge is to come up with ways to motivate students to take more notes on matters they thought important in class, not just fill in blanks, and to show that test scores of essay questions can be improved.

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References

- Association of Digital Textbook & Teaching(2012). DiTT, <http://ditt.jp>
- Kishi, T., Thukada, H., and Nojima, E., (2004) . Relation Analysis of Presence of Note Taking and Test Score After the Lecture: Japan Journal of Educational Technology, vol.28(Suppl.), 265-268.
- Nozaki, H., Yoshihashi, A., Umeda, K., Ejima, T., (2005). The Effects of Writing the Text on Readers' Comprehension: Japan Journal of Educational Technology, vol.29(Suppl.),49-52.
- Hartley and Davies, (1983). Note-taking: A critical review. Programmed Learning and Educational Technology, 15: 207-224.
- Hartley, J. (1983). Note-Taking research: Re-setting the scoreboard. Bulletin of the British Psychological Society, 36: 13-14.
- Yamamoto, H., Nakayama, M., Shimizu, Y., (2012). The Estimation for Descriptive Promotion Plan to e-Notebook Age: Proceedings of the 28th Annual Conference of JSET, pp.375-376.
- Ando, M., and Ueno, M., (2011). Effect Analysis of e-Learning that Users Tablet PC: Japan Journal of Educational Technology, vol.35(2), 109-123.
- Nakayama, M., Mutsuura, K., Yamamoto, H., (2010). Effectiveness of Note Taking Activity in a Blended Learning Environment: In 9th European Conference of E-Learning, pp.387-393. Academic Publishing, Reading, UK
- Weener, P., (1974). Note taking and student verbalization as instrumental learning activities, Instructional Science, 3, pp.51-74
- Kiera, K.A., (1989). A Review of Note-Taking: The Encoding-Storage Paradigm and Beyond: Educational Psychology Review, 1(2), pp.147-172
- Trafton, G.J., Trickett, S.B., (2001). Note-Tking for Self-Explanation and Problem Solving: Human-Computer Interaction, 16, pp.1-38
- Nakayama, M., Mutsuura, K., Yamamoto, H., (2011). Evaluation of Student's Notes in a Blended Learning Course: Int. J. Of New Computer Architectures and their Applications (INJ-CAA), Vol.1, No.4, 1080-1089, Aug. 2011
- Mayer, R.E.(2001), Multimedia Learning. Cambridge University Press, NY